

Status of the Meteorological Data Format Working Group

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Outline

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Background

- The Meteorological Data Transfer Format (MDTF) was developed to be used by NASA, the Air Force, and others for the Space Shuttle program. After this program ended, use of MDTF was maintained.
- MDTF offers a unique format including units and character formatting for each data source:
 - Wind Towers
 - Low Resolution Flight Element balloons (LR)
 - Winds only balloons [Low Resolution Flight Element balloon (LW), High Resolution Flight Element balloons (HR), and Jimsphere balloons (JS)]
 - 48 MHz Tropospheric Doppler Radar Wind Profiler (TDRWP)
 - 915 MHz DRWP
- Additionally, MDTF was designed so that files would be readable to users (ASCII) and easy to analyze with the FORTRAN programming language.

Background

- Limitations of the MDTF format include:
 - 80 character limit per line. Lines of data can be difficult to read due to lack of delimiters and some data being separated across two or more lines.
 - No data values are sometimes denoted with white space and other times as “-999”.
 - LR balloon data uses multiple termination lines and headers to separate interpolated data, mandatory data, and significant levels.
 - Meta data in TDRWP and DRWP files can be difficult to read or understand.
 - There exist data recorded by balloons that aren’t included in this format.

Motivation

- Conversations arose from the Range Commander's Council Meteorology Group (RCC MG) discussing the limitations of MDTF, which come from MDTF being designed for older technologies. Further discussion was held at the Spring 2016 NEDOLWG and was met with general agreement that many users convert data from MDTF to another format before performing any analysis.
- As a new program begins, Space Launch System (SLS), an opportunity arises for the community of users to discuss, decide upon, and develop a new meteorological data format to replace MDTF.
- The Meteorological Support Interface Control Working Group (MSICWG) was formed to give meteorological data users from the Eastern Range (ER), Kennedy Space Center (KSC), Johnson Space Center (JSC), and Marshall Space Flight Center (MSFC) a forum to discuss the status of instruments, networks, and data in support of the Space Shuttle program and has been carried over to support SLS.
- A team was formed as part of the MSICWG over the summer of 2016 to begin developing new formats and discuss methods of implementation. This presentation presents the initial formats developed by the working group.

Team Background

- The team consists of members of the MSICWG; data users from MSFC, JSC, KSC, and ER.
- Team members were selected for their experience with data and for using data in unique applications.
- For example:
 - MSFC users: Aid in vehicle design, Build climatologies for future engineering needs, Provide Day-of-Launch (DOL) support
 - JSC users: Provide operational forecasts for DOL and landing, Provide weather data to Mission Control for engineering purposes
 - KSC/ER: Provide operational forecasts for NASA, Air Force, and commercial space vehicle launches, Meteorological analysis of local weather for Ground Systems Development and Operations (GSDO) support
- By putting together a group from multiple centers/programs, with multiple unique interests in the data, new formats can be created with all users in mind.

Team Goals

- Develop new formats to improve upon the currently used MDTF formats.
 - All members of the working group agree upon the new formats.
 - Proposed formats are presented to users across the community supporting SLS for discussion.
- Write documentation outlining and describing the new formats.
 - Will be based on the current MDTF documentation the describes the format.
 - Find proper ownership and support for new documentation.
- Develop methods to implement new formats.
 - As instruments, networks, and requirements are updated, the new formats can be integrated into the data dissemination process.

Current Work

- Three new formats have been discussed:
 - LR
 - TDRWP
 - Wind Tower
- The team is seeking feedback from the community on these new formats as well as other discussed changes, such as:
 - Units
 - Missing data flags
 - Additional data to include in formats

Current Work: LR Format

- All data from the current format is retained in the proposed format.
- Data is space delimited.
- A character at the beginning of each line identifies the source of the data: Interpolated, Mandatory, and Significant levels.
- All data fields from Interpolated data, Mandatory levels, and Significant levels are included on each line.
- Additional data included in the proposed format:
 - Longitude and Latitude
 - Ascent rate

Current Work: LR Format

LR012722350 201509292350 CCAFS

RAWINSONDE AMP/LR TEST NBR A1806 WS1

ID	ALT	ALT	DIR	SPD	SHR	ASCENT	TEMP	DPT	PRESS	RH	ABHUM	DENSITY	I/R	V/S	VPS	PW	LATITUDE	LONGITUDE
	GEOMFT	GEOPFT	DEG	KTS	/SEC	F/S	DEGC	DEGC	MBS	PCT	G/M3	G/M3	N	KTS	MBS	MM	DEGREES	DEGREES
I	16	-999	210	4.0	-999	-999	27.5	25.9	1008.80	91	24.09	1154.28	398	680	33.42	0	34.9286	-117.9033
I	1000	-999	246	16.4	.023	-999	25.3	22.0	975.32	82	19.16	1126.81	364	677	26.39	6	-999.0000	-999.0000
I	2000	-999	270	15.6	.011	-999	23.2	20.9	942.16	87	18.03	1096.59	351	674	24.66	12	-999.0000	-999.0000
I	3000	-999	276	16.8	.004	-999	21.3	19.6	909.92	90	16.84	1066.31	338	672	22.88	17	-999.0000	-999.0000
I	4000	-999	290	18.2	.007	-999	19.6	18.1	878.55	91	15.35	1036.14	323	670	20.74	22	-999.0000	-999.0000
I	5000	-999	284	19.8	.004	-999	18.0	17.2	848.10	95	14.61	1005.90	312	668	19.63	27	-999.0000	-999.0000
...																		
M	-999	758	8	9.0	-999	-999	16.8	7.3	1000.00	54	-999.00	-999.00	-999	-999	-999.00	-999	-999.0000	-999.0000
M	-999	2182	79	10.0	-999	-999	12.6	5.6	950.00	62	-999.00	-999.00	-999	-999	-999.00	-999	-999.0000	-999.0000
M	-999	2915	94	12.0	-999	-999	10.8	4.9	925.00	67	-999.00	-999.00	-999	-999	-999.00	-999	-999.0000	-999.0000
...																		
S	800	-999	8	8.0	-999	-999	16.6	7.2	998.50	54	-999.00	-999.00	313	-999	-999.00	-999	-999.0000	-999.0000
S	3900	-999	103	15.0	-999	-999	8.2	4.2	892.40	76	-999.00	-999.00	285	-999	-999.00	-999	-999.0000	-999.0000
S	4100	-999	103	14.0	-999	-999	7.6	3.8	885.80	77	-999.00	-999.00	283	-999	-999.00	-999	-999.0000	-999.0000
...																		
NNNN																		

Current Work: PS Format

- All data from the current TDRWP format is kept in the proposed format.
- Extra blank lines in between lines of data are removed.
- Data values are space delimited.
- The data that was in the footer has been moved to the header. Descriptive text and units are included with the new header data.

Current Work: PS Format

PS072731210 201509301209 CCAFS/KSC

TROPOSPHERIC PROFILER

E AZI	N AZI	V AZI	E ELE	N ELE	V ELE	#FFT	E TMEDOMAVG	N TMEDOMAVG	V TMEDOMAVG							
DEG	DEG	DEG	DEG	DEG	DEG	NA	NA	NA	NA							
135.0	45.0	0.0	75.3	75.3	90.0	096	30	30	30							
E SPECavg	N SPECavg	V SPECavg	E PULREP	N PULREP	V PULREP	E VERTGTSPC	N VERTGTSPC	V VERTGTSPC	E VERTGTWID							
NA	NA	NA	MICROSEC	MICROSEC	MICROSEC	METER	METER	METER	METER							
3	3	3	153.8	153.8	153.8	149	149	149	149							
N VERTGTWID	V VERTGTWID	MAXACVOLT	MINACVOLT	TRANSPower	NOISETEMP	REFLECTPWR	DRVROUTPWR	DRVRIINPWR	TRANSTEMP							
METER	METER	VOLTS	VOLTS	KW	DEG K	WATTS	WATTS	WATTS	DEG K							
149	149	640	0	187	20	2919	0	0	0							
ENCLOSTEMP	FLOODALRM	ACSALRM	CODEBITS	ETPMDFLTCD	N TPMDFLTCD	V TPMDFLTCD	E RUNMEANCD	N RUNMEANCD	V RUNMEANCD							
DEG K	NA	NA	NA	NA	NA	NA	NA	NA	NA							
47	4	0	5	3	3	3	0	0	5							
ALT	DIR	SPD	SHR	WW	S1	S2	S3	N1	N2	N3	WID1	WID2	WID3	G	G	QC
GEOM	DEG	M/S	/SEC	M/S	DB	DB	DB	DB	DB	DB	M/S	M/S	M/S	1	2	NN
1798	234	14.0	.000	-0.12	111.5	109.9	110.8	62.0	62.6	62.3	0.8	0.5	0.64	0	0	64
1948	233	14.0	.001	-0.06	115.0	114.6	114.8	62.1	62.7	62.4	0.9	0.5	0.70	0	0	64
2098	238	14.3	.008	-0.19	117.7	117.3	117.5	60.5	61.2	60.9	0.9	0.5	0.68	0	0	64
2247	242	14.4	.006	-0.18	118.0	113.5	116.3	61.3	61.9	61.6	0.7	0.5	0.60	0	0	64
2397	244	14.4	.004	-0.09	118.7	117.2	118.0	62.2	62.6	62.4	0.9	0.5	0.70	0	0	64

...
NNNN

Current Work: WT Format

- All data from the current Wind Tower format is kept in the proposed format.
- Additional fields of data are included for location of tower (latitude and longitude) and future instruments (direct/diffuse solar radiation, soil moisture, soil temperature).
- Fields of data are space delimited.
- If no data is available, a value of “-999” is given instead of the blank space.

Current Work: WT Format

- Options for Wind Tower data:
 1. One file contains all towers for each 1 or 5 minute interval. Each tower height has its own line of data.
 - Pros: Easy to update format as new instruments are added.
 - Cons: Difficult to read data.
 2. One file per tower for each 1 or 5 minute interval. Each tower height has its own line of data.
 - Pros: Easy to update format as new instruments are added. Easy to read since there is only one tower per file.
 - Cons: Puts a strain on the servers to produce 60,480 files daily compared to the 1,728 currently created.

Current Work: WT Format Option 1

WT010711602 201603111602 CCAFS/KSC

WIND TOWER DATA

TOWER	HGT	AV	01 MIN		01 MIN		10 MIN		DEV	TMP		DP	RH	PRE	DIFRAD	REFRAD	SLTEMP	SLMOIST	LAT	LON
			DIR	SPD	DIR	SPD	DIR	SPD		TMP	DIF									
	FT	MIN	DEG	KTS	DEG	KTS	DEG	KTS	DEG	F	F	F	%	MB	W/M2	W/M2	F	MM	DEG	DEG
0108	06	01	-999	-999	-999	-999	-999	-999	-999	77.4	-999.0	-999.0	-999	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
0108	12	01	139	7	151	15	140	19	022	-999.0	-999.0	-999.0	-999	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
0108	54	01	141	14	141	19	142	23	011	75.0	-2.4	-999.0	-999	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	132	01	157	21	157	25	157	26	004	73.7	-999.0	62.8	69	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	133	01	145	17	137	23	157	25	004	74.2	-999.0	61.2	64	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	134	01	153	12	153	17	155	21	003	73.7	-999.0	59.8	62	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	257	01	156	22	153	24	153	26	003	72.7	-999.0	59.8	64	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	258	01	140	19	145	23	144	25	004	73.1	-999.0	61.1	66	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	259	01	152	12	153	17	154	19	002	72.8	-999.0	60.0	64	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	382	01	161	22	154	24	159	26	002	72.0	-999.0	57.4	60	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	383	01	144	19	136	23	149	26	003	72.3	-999.0	60.6	67	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	384	01	154	8	160	12	147	13	003	72.2	-999.0	59.9	65	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	457	01	158	22	153	24	157	26	002	71.6	-999.0	60.3	68	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	458	01	146	19	149	23	145	26	003	71.9	-999.0	60.4	67	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	459	01	192	1	193	7	165	9	047	72.0	-999.0	59.5	65	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0

Current Work: WT Format Option 2

WT010711602 201603111602 CCAFS/KSC

WIND TOWER DATA 0108

TOWER	HGT	01 MIN				01 MIN		10 MIN		DEV	TMP	DIF	DP	RH	PRE	DIFRAD	REFRAD	SLTEMP	SLMOIST	LAT	LON
		AVERAGE		PEAK		PEAK															
		AV	DIR	SPD	DIR	SPD	DIR	SPD													
	FT	MIN	DEG	KTS	DEG	KTS	DEG	KTS	DEG	F	F	F	%	MB	W/M2	W/M2	F	MM	DEG	DEG	
0108	06	01	-999	-999	-999	-999	-999	-999	-999	77.4	-999.0	-999.0	-999	-999	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	
0108	12	01	139	7	151	15	140	19	022	-999.0	-999.0	-999.0	-999	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	
0108	54	01	141	14	141	19	142	23	011	75.0	-2.4	-999.0	-999	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	

WT010711602 201603111602 CCAFS/KSC

WIND TOWER DATA 39 B NW

			01 MIN		01 MIN		10 MIN													
TOWER	HGT	AV	AVERAGE		PEAK		PEAK		DEV	TMP		DP	RH	PRE	DIFRAD	REFRAD	SLTEMP	SLMOIST	LAT	LON
			DIR	SPD	DIR	SPD	DIR	SPD		F	F									
39 B NW	132	01	157	21	157	25	157	26	004	73.7	-999.0	62.8	69	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	133	01	145	17	137	23	157	25	004	74.2	-999.0	61.2	64	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	134	01	153	12	153	17	155	21	003	73.7	-999.0	59.8	62	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	257	01	156	22	153	24	153	26	003	72.7	-999.0	59.8	64	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	258	01	140	19	145	23	144	25	004	73.1	-999.0	61.1	66	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	259	01	152	12	153	17	154	19	002	72.8	-999.0	60.0	64	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	382	01	161	22	154	24	159	26	002	72.0	-999.0	57.4	60	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	383	01	144	19	136	23	149	26	003	72.3	-999.0	60.6	67	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	384	01	154	8	160	12	147	13	003	72.2	-999.0	59.9	65	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	457	01	158	22	153	24	157	26	002	71.6	-999.0	60.3	68	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	458	01	146	19	149	23	145	26	003	71.9	-999.0	60.4	67	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0
39 B NW	459	01	192	1	193	7	165	9	047	72.0	-999.0	59.5	65	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0	-999.0

Future Work

- JS/HR/LW and RW formats need to be discussed and agreed upon.
- A document describing the new formats needs to be finalized.
- Methods of implementation need to be decided upon.